Name: ____________________ Date: ____________________

Polynomial Operations SOLUTION (version 244)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -9x^5 + 2x^4 + 10x^3 - 5x^2 - 8$$

$$q(x) = 3x^5 + 7x^3 - 4x^2 - 9x + 6$$

Express the sum of $p(x) + q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$p(x) = (-9)x^5 + (2)x^4 + (10)x^3 + (-5)x^2 + (0)x^1 + (-8)x^0$$
$$q(x) = (3)x^5 + (0)x^4 + (7)x^3 + (-4)x^2 + (-9)x^1 + (6)x^0$$
$$p(x) + q(x) = (-6)x^5 + (2)x^4 + (17)x^3 + (-9)x^2 + (-9)x^1 + (-2)x^0$$
$$p(x) + q(x) = -6x^5 + 2x^4 + 17x^3 - 9x^2 - 9x - 2$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 8x^2 - 9x + 2$$

$$b(x) = 4x + 7$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$8x^2$	$-9x$	2
$4x$	$32x^3$	$-36x^2$	$8x$
7	$56x^2$	$-63x$	14

$$a(x) \cdot b(x) = 32x^3 - 36x^2 + 56x^2 + 8x - 63x + 14$$

Combine like terms.

$$a(x) \cdot b(x) = 32x^3 + 20x^2 - 55x + 14$$

3. Express $(x + 1)^5$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

Polynomial Operations SOLUTION (version 244)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 4x^3 - 24x^2 - 6x + 26 \\ g(x) &= x - 6 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-6}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{c|cccc} & 4 & -24 & -6 & 26 \\ 6 & & 24 & 0 & -36 \\ \hline & 4 & 0 & -6 & -10 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 4x^2 - 6 + \frac{-10}{x-6}$$

In other words, $h(x) = 4x^2 - 6$ and the remainder is $R = -10$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 4x^3 - 24x^2 - 6x + 26$. Evaluate $f(6)$.

You could do this the hard way.

$$\begin{aligned} f(6) &= (4)\cdot(6)^3 \;+\; (-24)\cdot(6)^2 \;+\; (-6)\cdot(6) \;+\; (26) \\ &= (4)\cdot(216) \;+\; (-24)\cdot(36) \;+\; (-6)\cdot(6) \;+\; (26) \\ &= (864) \;+\; (-864) \;+\; (-36) \;+\; (26) \\ &= -10 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(6)$ equals the remainder when $f(x)$ is divided by $x - 6$. Thus, $f(6) = -10$.